1857MNRAS..17..158B

Whence for $M = 26^{\circ}{\cdot}35794$, we shall have $\varepsilon = 71^{\circ}{\cdot}12136$.

The error is $0^{\circ}{\cdot}003$. The correction $\Delta\,\varepsilon$ comes out $+\ 0{\cdot}00472$."

Whence, lastly, $\varepsilon = 71^{\circ}{\cdot}12608$. Error $= 0^{\circ}{\cdot}000003$.

An Expeditious Method of finding the Latitude by simply observing the Azimuthal Angles of two Circumpolar Stars with a Theodolite. By M. Babinet.

(*Communicated by Admiral W. H. Smyth.*)

It is presumed that the method is designed to meet the case of a traveller, who, from other considerations, has been led to take with him a small theodolite and pocket-chronometer, to the exclusion of a sextant or repeating circle; and that he has with him a catalogue of the brighter stars. Regarded otherwise, the method would be much inferior to others already known.

In the well-known triangle Z P S, let Z be the zenith, P the pole, and S the place of a circumpolar star. $ZP = 90 - \lambda$. $PS = \delta$. $PZS = A$, the azimuth of the star.

Then

$$\sin A \,.\, \cos\lambda = \sin\delta \,.\, \sin PSZ$$

It is proposed that the star's azimuth shall be observed when at its greatest elongation, in which case $PSZ = 90^{\circ}$, and the above equation becomes

$$\sin A \,.\, \cos\lambda = \sin\delta \qquad (1)$$

Similarly for the second star we should have

$$\sin A' \,.\, \cos\lambda = \sin\delta' \qquad (2)$$

Dividing (1) — (2) by (1) + (2), we then have

$$\frac{\tan\frac{1}{2}(A-A')}{\tan\frac{1}{2}(A+A')} = \frac{\tan\frac{1}{2}(\delta-\delta')}{\tan\frac{1}{2}(\delta+\delta')} \qquad (3)$$

When the two stars are observed at opposite elongations, A and A′ will have opposite signs, and A + A′ will be found at once from the difference of the two readings of the horizontal circle, half the difference will be

$$\tfrac{1}{2}(A + A')$$

By equation (3) we thence get

$$\tfrac{1}{2}(A - A')$$

Thence A and A′ separately, and by either (1) or (2) the required latitude λ.

Having found from A or A′ the azimuthal reading of the pole, we can then set the telescope in the meridian, and obtain the time very nearly by a transit of an intertropical star. The whole operation need not take more than twenty minutes, if the stars are previously suitably selected.

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1857MNRAS..17..159A

M. Babinet gives the following example for a place, the latitude of which is 51° 49′ north. Suppose the theodolite levelled, and the reading of the horizontal circle for the azimuth of the pole to be 67° (unknown); suppose, further, the two stars selected to be

		R.A. h m		N.P.D. ° ′
	ε Cassiopeæ	R.A. = 1 44	N.P.D. =	27 3
and	ο Urs. Maj.	8 18		28 48

and the observation to be made on the 1st of March, 1857.

A rough preliminary calculation by the relation

$$\cos h = \tan \delta \,.\, \tan \lambda$$

made with a guessed value of λ will show that ε *Cassiopeæ* will attain its greatest east elongation at about $6^{h}\ 24^{m}$ after noon, and ο *Urs. Maj.* its greatest west elongation at about $6^{h}\ 37^{m}$, the second observation following the first in about 13 minutes.

The horizontal circle-readings will be respectively for ε *Cassiopeæ* 114° 21′·2; for ο *Urs. Maj.* 15° 48′·1; whence we find

$$\tfrac{1}{2}(\mathrm{A}+\mathrm{A}') = +49^{\circ}\ 16'{\cdot}6$$

and by (3),

$$\tfrac{1}{2}(\mathrm{A}-\mathrm{A}') = -\ 1\ 55{\cdot}0$$

$$\mathrm{A} = 47\ 21{\cdot}6 \text{ East}$$

$$\mathrm{A}' = 51\ 11{\cdot}6 \text{ West}$$

and by either (1) or (2),

$$\lambda = 51\ 49$$

To ascertain how the result would be affected by errors of observation, differentiate the equations (1) and (3), and it will be found that

$$d\lambda = \cot\lambda \,.\, \frac{\cos \mathrm{A} \,.\, \cos \mathrm{A}'}{\sin(\mathrm{A}+\mathrm{A}')} \,.\, d(\mathrm{A}+\mathrm{A}');$$

whence we may conclude that for such a pair of stars as the above, the error of the resulting latitude will scarcely exceed one-third of the error of the observed difference of azimuths.

At the conclusion of the ordinary business of the meeting, the Astronomer Royal exhibited and explained a model of the stand now in use at the Royal Observatory for the support of the mercury vessel of the reflex-zenith-tube. Considerable difficulty had been experienced, as is well known, in the use of this instrument on its first establishment, from the constant presence of tremor, and it was twice taken down and remounted in new positions, with little, if any, relief from the annoyance sought to be avoided. Indeed, the continual agitation of the artificial horizon seemed to testify to a never-ceasing palpitation of the soil of the Greenwich hill. After alluding to the expedients which were previously and vainly resorted to, and which are recounted in the Annual Reports

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